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(54) PROCESS FOR THE MANUFACTURE OF PRINTING PLATES AND LIGHT-SENSITIVE MATERIAL FOR USE IN THE PROCESS

(71) We, HOECHST AKTIENGESELLSCHAFT, a body corporate organised according to the laws of the Federal Republic of Germany, of 6230 Frankfurt/Main 80, Federal Republic of Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a process for the manufacture of planographic printing plates in which process a light-sensitive layer disposed on a metallic carrier is exposed image-wise and is then developed and the developed copying material is warmed by means of infra-red radiation to consolidate the parts of the layer remaining after development. The invention also relates to a light-sensitive material for use in such a process.

Such a process is described in German Offenlegungsschrift No. 1,955,378. In that process the light-sensitive layer is preferably irradiated with infra-red radiation from the layer side of the material to keep heat exposure of the carrier as small as possible.

It has been found, however, that this method of working has certain disadvantages because the infra-red radiation is more strongly absorbed by the remaining image areas of the copying layer than by the strongly reflective carrier surface in the non-image areas. Thus the layer to be hardened or stoved is warmed to higher temperatures in area of high image density than in areas of low image density and the areas of the carrier surface which are completely image-free are warmed least of all. Thus non-uniform stoving of the layer can result. Furthermore, because of the strong reflective properties of the carrier material, only a part of the radiation is usefully utilised.

It is an object of the present invention to provide a process and a copying material which permit uniform stoving of all image areas of the layer and better utilisation of the radiation energy.

The present invention provides a process for the manufacture of a printing plate which comprises imagewise exposing a light-sensitive copying material comprising a metallic carrier having on one surface thereof a positive—or negative-working photoresist layer and on the other surface thereof a layer of a material which absorbs infra-red radiation, developing the said material by treating it with a liquid developer to remove areas soluble in the developer, and heating the developed material by exposing the layer of material on the said other surface of the carrier to infra-red radiation.

In a preferred embodiment, the photoresist layer comprises a quinone diazide; a positive-working photoresist comprising an *o*-naphthoquinone diazide is especially preferred.

The invention also provides a light-sensitive copying material for the manufacture of printing plates, which material comprises a metallic carrier having on one surface thereof a positive or negative-working photoresist containing a quinone diazide, preferably an o-naphthoquinone diazide, and on the other surface thereof a layer of a material capable of absorbing infra-red radiation.

In the process of the invention it is possible to use any copying material which comprises, on a metal carrier, a photoresist layer suitable for the manufacture of planographic printing plates or offset printing plates. The photoresist layer may be positive — or negative —, working, that is to say it may become more easily soluble or more sparingly soluble in a developer solution as a result of exposure. Suitable layers are, for example, photopolymerisable or light-crosslinkable layers, polymer layers sensitised by diazonium compounds or

azides and, especially, as mentioned above, layers which comprise quinone-diazides; such layers which also contain phenolic resin, for example novolaks or resoles, are specially preferred. Amongst these, positive-working layers of *o*-naphthoquinone-diazides and novolaks or resoles, for example those described in German Offenlegungsschrift No. 1 447 963, are of the greatest industrial importance. The process can, in principle, be applied to any material where it is intended to print from the parts of the layer which remain after developing and in which these parts of the layers can be consolidated yet further, or stoved, by warming.

As suitable carrier materials practically any metallic carrier customarily used for offset printing plates, for example aluminium, brass or steel, may be used. In general, aluminium, the surface of which can be mechanically, chemically or electro-chemically roughened and optionally anodised, is preferred. The process of the invention is especially effective in the case of highly reflective anodised aluminium carriers.

The layer of material which absorbs infra-red radiation is located on the surface of the carrier remote from the copying layer, i.e. on the rear of the carrier, and appropriately is applied to the carrier during manufacture of the copying material. The absorption layer should be such that it adheres firmly to the carrier material and is not abraded during handling and processing of the latter, so that the copying layer of a light-sensitive plate lying underneath it in a stack will not be damaged. Carbon black particles especiaally have proved suitable as the material which absorbs infrared radiation. Other pigments, such as graphite, finely divided metals, for example, aluminium powder, are also very suitable. The material which absorbs infra-red radiation, for example a pigment, is conveniently contained in, for example, embedded in, a layer of binder. Depending on the requirement for heat stability of the layer, the binder can be inorganic or organic in nature. For example, waterglass has proved successful as an inorganic binder and is additionally distinguished by an intrinsic absorption of infra-red radiation. Thus, for example, a degree of absorption of 0.96 is achievable with a layer of waterglass and carbon black particles. Pigment particles, for example, can also be embedded in a thin high temperature-resistant plastics film, for example of a polyimide, this film then being laminated to the rear of the carrier material. The pigment particles can also be applied as a dispersion in a solution of a lacquer which is optionally curable. In the case of aluminium carriers it is also possible to colour an electrolytically produced oxide layer with suitable dyestuffs which absorb infra-red radiation, but in general it is not possible to achieve such high degrees of absorption by this method as with pigments, especially with layers of carbon black.

The processing of the copying material up to stoving of the image may be carried out in a manner which is in itself known, for example as described in German Offenlegungsschriften Nos. 1,447,962 and 1,447,963. Stoving is conveniently carried out in an oven under one or more infra-red radiators, the source of radiation being such that it warms uniformly the entire rear surface of the carrier. As a result of the good heat conduction of the metal carrier, the entire image layer located on the opposite side is, for practical purposes, stoved substantially uniformly.

During this process, it is desirable to support the copying material so that it is thermally insulated, and its temperature can be checked with a thermocouple, as is described in German Offenlegungsschrift No. 1,955,378.

The invention is illustrated, by way of example only, with reference to the drawing which shows schematically an arrangement of a developed printing plate in a stoving chamber.

Referring to the drawing, a printing plate comprises a carrier 1, preferably an aluminium foil, which has on one surface thereof a copying layer 2 of a light-sensitive material which has been exposed image-wise and has been developed. The other surface of the carrier 1 has a layer 3 of a material which absorbs infra-red radiation. Infra-red radiation 4 symbolised by arrows is generated by a radiator 5 and is directed by a reflector 6 onto the layer 3.

The radiator 5 and the reflector 6 are moved relative to the plate so that the radiation scans the entire surface of the plate. Alternatively, it is, for example, possible to use several adjacent radiators which simultaneously irradiate the entire plate surface with a uniform intensity.

WHAT WE CLAIM IS:—

1. A process for the manufacture of a printing plate which comprises imagewise exposing a light-sensititve copying material comprising a metallic carrier having on one surface thereof a positive—or negative—working photoresist layer and on the other surface thereof a layer of a material which absorbs infra-red radiation, developing the said material by treating it with a liquid developer to remove areas soluble in the developer, and heating the developed material by exposing the layer of material on the said other surface of the carrier to infra-red radiation.

2. A process as claimed in claim 1, wherein the photoresist layer comprises a quinone diazide.

3. A process as claimed in claim 2, wherein the photoresist layer is a positive-working photoresist layer comprising an *o*-naphthoquinone diazide.

4. A process as claimed in claim 2 or claim 3, wherein the photoresist layer also comprises a phenolic resin.

5. A process as claimed in any one of claims 1 to 4, wherein the material which absorbs infra-red radiation comprises carbon black particles embedded in a binder.

6. A process as claimed in claim 5 wherein the binder is waterglass or a plastics material.

7. A process as claimed in any one of claims 1 to 6, wherein the metallic carrier comprises aluminium.

8. A process as claimed in claim 1, carried out substantially as described here with reference to, and as shown in, the accompanying drawing.

9. A printing plate which has been manufactured by a process as claimed in any one of claims 1 to 8.

10. A light-sensitive copying material for the manufacture of printing plates, which material comprises a metallic carrier having on one surface thereof a positive—or negative—working photoresist containing a quinone diazide and on the other surface there of a layer of a material capable of absorbing infra-red radiation.

11. A material as claimed in claim 10, wherein the photoresist layer is a positive-working photoresist layer comprising an *o*-naphthoquinone diazide.

12. A material as claimed in claim 10 or claim 11, wherein the photoresist layer also comprises a phenolic resin.

13. A material as claimed in any one of claims 10 to 12, wherein the material capable of absorbing infra-red radiation comprises carbon black particles. embedded in a binder.

14. A material as claimed in claim 13, wherein the binder is waterglass or a plastics material.

15. A material as claimed in any one of claims 10 to 14, wherein the metallic carrier compirses aluminium.

16. A material as claimed in claim 10, substantially as hereinbefore described.

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